

TRAFFIC SIGNAL DESIGN

Technical Design Manual #5



Chandler ✦ *Arizona*

January 2002

TRAFFIC SIGNAL DESIGN CITY OF CHANDLER

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Traffic Signal Details

TRAFFIC SIGNAL DESIGN CITY OF CHANDLER

List of Details

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Details follow page 8 of the Manual

FORWARD

The purpose of this manual is to assist developers and their consultants in the planning and design of traffic signals within the city of Chandler's right of way. The guidelines contained within this manual are intended for use by professional engineers and designers with a background in the underlying fundamentals in Traffic Engineering. This manual does not provide the answers for all situations involving the design of traffic signals. It does, however, provide the tools for solving most of them. It is expected that those designing traffic signals within the City of Chandler bring to each project the skills and abilities to provide the optimum traffic control device to the public. This may include any new signal design concepts that result in a higher quality of traffic control and/or cost effectiveness. Deviations from these standards must be approved by the City of Chandler Transportation Engineer prior to submittal for review and approval.

This manual is divided into the following sections:

Developer's Checklist	Electrical Service
Plan Development	Signal Poles
Conduit & Conductors	Junction Boxes
Controller & Cabinet	Detectors
Internally Illuminated Street Name Signs	Signal Heads

The City of Chandler is bounded by the City of Mesa, Town of Gilbert, Maricopa County, City of Tempe and the Gila River Indian Community. In situations where the intersection in question is bounded by more than one jurisdiction, the jurisdiction to the north and east are usually responsible for the roadway and the traffic signal. This should be verified before commencing with the signal design. In any case, the designer should confer with all adjacent jurisdictions during the signal design in order to incorporate any special considerations for those jurisdictions.

Any questions regarding the signal design should be addressed to:

City Transportation Engineer
City of Chandler
215 East Buffalo Street
Mail Stop 402
P.O. Box 4008
Chandler, Arizona 85224-4008
Phone: (480) 782-3455

1 - DEVELOPER'S CHECKLIST

A checklist has been developed to assist developers/consultants in the design of traffic signals in the City of Chandler. This checklist is not intended to be all inclusive, but a helpful guide in the design of traffic signals.

The following items should be researched for inclusion into the traffic signal design plans or in the development of the plans:

- ☐ Contact Blue Stake (602-263-1100) to determine existing utilities in the area.
- ☐ Survey the intersection for the development of a base plan. This survey should be performed after the intersection has been Blue Staked by the utility companies. In addition to the utilities, the survey should locate all existing roadway features within the intersection and 200 feet up each leg of the intersection. This includes face-of-curb, back-of-sidewalk, curb inlets, pavement markings, signs, walls and any landscaping that may affect the location of traffic signal equipment.
- ☐ Conduct a field visit of the intersection to verify the survey.
- ☐ Obtain maps from the utility companies and roadway as-builts from the City to supplement the survey.
- ☐ Contact the electric service company (Arizona Public Service (APS) or Salt River Project (SRPO)) to determine a power source location for the signal.
- ☐ Obtain existing and/or future right-of-way in the area and identify on the plans.

The developer/consultant should anticipate a minimum of two (2) submittals to the City prior to approval of the traffic signal. Upon approval of the signal, seven (7) sets of approved plans should be delivered to the City. These will be distributed as follows:

- 3 Sets - Development Services Plans Review Branch
- 2 Sets - Traffic Engineering Branch
- 1 Set - Signal Maintenance Shop
- 1 Set - Inspection

Plan approvals are limited to six (6) months after the approval date and may be renewed for another six (6) months if no changes to the existing or future intersection configuration have occurred.

2 - ELECTRICAL SERVICES

The City of Chandler is served by two electrical service companies: Salt River Project (SRP) and Arizona Public Service (APS). The service areas for each company are provided in Figure TS-1. The signal designer should contact the appropriate utility company early in the design process so that a "point of service" location can be identified. The contact phone number and address for each utility contact is as follows:

Mr. Ken Barry
Salt River Project
EVS 107
PO Box 52025
Phoenix, Arizona 85072-2025
Phone: (602) 236-0840

Mr. Steve Goodman
Arizona Public Service
PO Box 53933
Mail Station 3162
Phoenix, AZ 85072-3933
Phone: (602) 371-6965

Effective May 1, 2001 all traffic signals are METERED power service.

3 - PLAN DEVELOPMENT

Traffic signal plans submitted for approval by the City of Chandler should be prepared using the Computer Aided Design and Drafting (CADD) software AutoCAD(r) and comply with the City of Chandler's CADD Standards as indicated below.

The City of Chandler uses a coversheet and two plan sheets for the design of traffic signals, see Figures TS-2, TS-5 and TS-6.

Coversheet (*Figure TS-2*) contains the project title, vicinity map and the general Notes. Contact the City of Chandler Development Services for format and Content requirements.

Sheet 1 (*Figure TS-5*) is used for the signal layout and contains a legend and the Notes to the contractor.

Sheet 2 (*Figure TS-6*) contains the pole and cabinet schedule, conductor Schedule, phasing schedule and wiring diagrams.

(The schedules and wiring diagrams in Fig. TS-5 are shown in greater detail in Figures TS-9 through 12.)

All symbols used in the design of traffic signals shall conform to Arizona Department of Transportation standards. These are summarized in Figs. TS-3 and TS-4.

AutoCAD(r) has the ability to place design information on several different layers in a file. This allows the separation of different design elements onto separate layers. The following is a recommended layering structure for the design of traffic signals:

SHEET 1 (*Plan View*)

Layer 1 (name – Title) shall be reserved for the border, title block, and legend.

Layer 2 (name – Ex.Roadway) shall be reserved for the existing roadway Configuration including curbs, sidewalks, striping, signing and edge of pavements

Layer 3 (name – Utilities) shall be reserved for any existing signals, including Junction boxes and conduit specifically used for traffic signal.

Layer 5 (name – New Signal) shall be reserved for all new signal equipment as Part of the signal design. Any general notes shall be included on this layer.

Layer 6 (name – Striping) shall be used for any striping or signing changes to be

Added in conjunction with the signal design.

Layer 7 (name – Construction) shall be reserved for any roadway improvements Needed in conjunction with signal installation.

Layer 8 (name – Future) shall be reserved for any future improvements to the Roadway, traffic signal, etc.

SHEET 2 (*Schedules and Diagrams*)

Layer 1 (name – Title) shall be reserved for the border and title block.

Layer 2 (name – Schedules) shall be reserved for the pole and cabinet, conductor and phase schedules

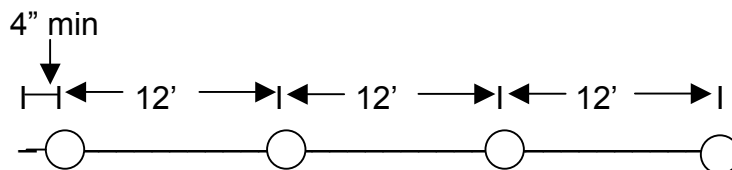
Layer 3 (name – Diagrams) shall be reserved for the wiring diagrams.

The Developer/Consultant shall submit electronic files to the City when plans are submitted for their approval signature. Approval of the design plans is contingent upon conformance to the above design formats.

4 - SIGNAL POLES

The City of Chandler uses standard ADOT signal poles and foundations. It is recommended that the designer obtain a current copy of ADOT's "Traffic Signals & Lighting" Standard Drawings and the latest Special Provisions. All poles shall be per ADOT specifications and TENON specifications.

Traffic Signal Tenon Locations for ADOT Standard Drawing



Typical Tenon Locations:

See Schedule for number of Tenons

Note: Not used for mast arms 20 foot or less

TENON SCHEDULE

<u>Pole Type</u>	<u>Arm Length</u>	<u># of Tenons</u>
K, R	45', 50', 55'	4
J, Q	35', 40'	3
J, Q	25', 30'	2
E, F	15', 20'	1

The City typically requires one pole for each corner of the intersection. Where site condition dictates, 2 poles may be used. One pole shall be a type "A" pole, while the

other shall be a “J” “K” or “Q” “R” depending on mast arm length and whether or not a luminaire is included on the pole. A typical pole layout is shown in Figure TS-13.

5 - JUNCTION BOXES

The City of Chandler uses two sizes of junction boxes; No. 5 and No. 7. These conform to ADOT’s Standards and Specifications. The No. 5 junction box is placed adjacent to the electrical “point of service” location as agreed to by the utility company. It is also used for the 6’x6’ system detector loops that may be required downstream from intersections. If needed, the No. 5 junction box shall be behind the sidewalk, adjacent to the stubout for the loops. The No. 7 junction box is placed on all corners of the intersection. It is generally placed behind the sidewalk at the center of radius. If no sidewalk or curbing exists or is planned with the signal installation, then the junction box should be placed as close as possible to the ultimate location. Figure TS-14 provides typical locations for function boxes, pedestal meter, and controller.

6 - CONDUIT AND CONDUCTORS

6.1 Conduit

The City of Chandler uses three conduit sizes for their traffic signals; 1½-inch, 2-inch and 4-inch. The 1½ -inch conduit is used for stub outs from the No. 5 and No. 7 junction for the loop detectors. The 2-inch conduit is used to connect the boxes and signal pole foundations. Two 2-inch conduits shall also be provided from the point of service. One of the 2-inch conduits shall be used between the point of service junction box and the controller cabinet foundation. The other 2-inch conduit shall be used between the point of service and the No. 7 junction box. The 4-inch conduit is used between the No. 7 junction boxes and is also used for any conduit run underneath the travelled way. Dual 3-inch conduits shall connect the controller cabinet foundation with a No. 7 junction box. All conduit runs shall be straight when possible. See figure TS-14 for meter pad and conduit placement.

6.2 Conductors

The City of Chandler uses standard IMSA conductor cables for the traffic signal wiring. The following describes the type and use of conductors:

- No. 14 AWG, 5 conductor is used from signal pole to inside mast arm head.
- No. 6 AWG is used between the power supply and the controller.
- No. 14 AWG, 7 conductor is used from signal pole to outside mast arm head.
- No. 8 AWG bare bond (green) is used in all conduit runs except loop detector only runs.

No. 10 AWG is used for the internally illuminated street name signs and the Luminaire. In addition, a common shall be included in the runs. Streetlight Conduction shall be red and street name sign conduction shall be brown. Conductors shall be fused in the No. 7 junction box.

IMSA 20-1 signal cable, No. 14 AWG 16 conductor is used between the Controller and each pole.

IMSA 50-2 lead in cable, No 14/16 AWG 2 conductor is used between each Loop detector and the controller.

Interconnect cable between the on-street Master and all local controllers shall be 12-pair, filled, 22 gauge, solid, shielded cable for telemetry use meeting IMSA SPEC-59-2-1986. All 12-pair shall be hooked onto terminal block, installed by The City in each traffic signal controller cabinet in the following order and color Code:

PAIR NO.	WIRE COLOR	MATE COLOR
1	Blue	White
2	Orange	White
3	Green	White
4	Brown	White
5	Slate	White
6	Blue	Red
7	Orange	Red
8	Green	Red
9	Brown	Red
10	Slate	Red
11	Blue	Black
12	Orange	Black

The 12-pair interconnect cable shall be run un-spliced from control cabinet to control cabinet. No splices will be allowed in between.

7 - CONTROLLER AND CABINET

7.1 Controller

The Controller Unit shall be a TS2, Type II EPAC 3608 Local System, wired with a "D" connector and Systems Input/Output terminal facility. It shall be fabricated and wired for the current City's MONARC System.

7.2 Cabinet

The Controller Cabinet shall be a TS2 Type IV per Arizona Department of Transportation Standard Specifications, 1990. It shall be fabricated from aluminum and the finish shall be unpainted and clean.

8 - DETECTORS

8.1 Quadrupole

Quadrupole, or call, loops are placed in the roadway at the intersection. The City typically uses 6'x50' and 6'x70' loop detectors. The 6'x50' loop detectors are used in the left turn bays while the 6'x70' detectors are used in the through lanes of minor cross streets at collector/arterial intersections and in selected through lanes at arterial/arterial intersections.

All loops should be centered in the lane. Figure TS-5 shall include the proposed pavement markings and removals to illustrate loop placement. They should also extend four feet beyond the stop bar into the intersection. Loop detectors added to existing pavements require 3M loop sealant after placement. If loop detectors are placed in an interim pavement lift during roadway construction, no 3M sealant is required. Typical sand and emulsified asphalt is acceptable. Figure TS-15 shows typical Quadrupole loop detector placement.

8.2 System Detector Loops

Arterial/arterial intersections require the placements of 6'x6' system detector loops. The loops shall be approximately 200 feet downstream from the intersection and oriented as shown in Figure TS-16.

8.3 Video Detection

The City of Chandler will use video vehicle detection in locations where Quadrupole loop detectors cannot be placed in the roadway pavement. This may occur at Locations with paving stones.

8.4 Opticom

The City of Chandler uses Opticom pre-emption equipment for emergency vehicles. Opticom detectors are mounted on the signal mast arms, centered between the two outside signal heads. Detectors shall be 3M model 700 series.

9 - SIGNAL HEADS

9.1 Visibility

The visibility of a signal head indication by a driver is the primary consideration in the placement of signal heads. The number of signal heads to be used for each approach shall be based on the policy outlined below.

1. For an approach without a left turn phase, two mastarm heads and one far-Left "A" pole-mounted head shall be used.
2. For an approach with a left turn phase, two mastarm heads are required for The through-right turn movements. One mastarm head and one far-left type "A" pole mounted head shall be used to satisfy the left turn movement.
3. For an approach in which the mastarm heads are located more than 120 Feet from the stop line, one near-right mounted head is required for through-right movements, in addition to the other signal heads Mentioned above.

9.2 Minimum Visibility Distance

The Manual of Uniform Traffic Control Devices (MUTCD) provides minimum visibility distances for signals. The following table, from Section 4B-12 of the MUTCD, provides the minimum distance from which two signals indications shall be continuously seen until reaching the stop bar. In cases where these requirements cannot be met, a "Signal Ahead" sign shall be installed to warn approaching traffic.

9.3 Placement of Signal Heads

Along the mast arm, the signal head for the left turn movement shall be located near the left side of the left turn lane extended. The signal heads for the through-right turn movements shall be located near the left side of the inside and outside through lanes extended. The minimum spacing between signal heads on the mastarm shall be 12 feet. Refer to Figure TS-17 for a diagram of signal head placement.

9.4 Signal Lamps

9.4.1 Vehicle Signals

All RED and GREEN signal lamps shall be LED and must comply with VTC SH standards published in the Equipment and Materials Standards of the Institute of Transportation Engineers (ITE).

9.4.2 Pedestrian Signals

Pedestrian traffic signal lamps shall be either neon or LED type and shall be enclosed in a 16" by 18" pedestrian signal housing built to the PTCSI standards published in the Equipment and Materials Standards of the Institute of Transportation Engineers (ITE). "Hand" and "Man" symbols shall be 12 inches in height and conform to PTCSI standards.

10 - INTERNALLY ILLUMINATED STREET NAME SIGNS

New traffic signal installations may require internally illuminated street name signs. Sign installations and placement shall conform to the standards and specifications outlined in the latest edition of the City of Chandler's Standard Details, C-600 through C-613. If height restrictions and/or conflicts exist, the City may consider alternatives to the details. All designs and installations must be approved by the City Transportation Engineer. Refer to Figure TS-18 for a diagram of pole mounting.



Chandler + Arizona
Where Values Make The Difference
City of Chandler
Public Works Dept.
215 East Buffalo Street
Chandler, AZ 85225

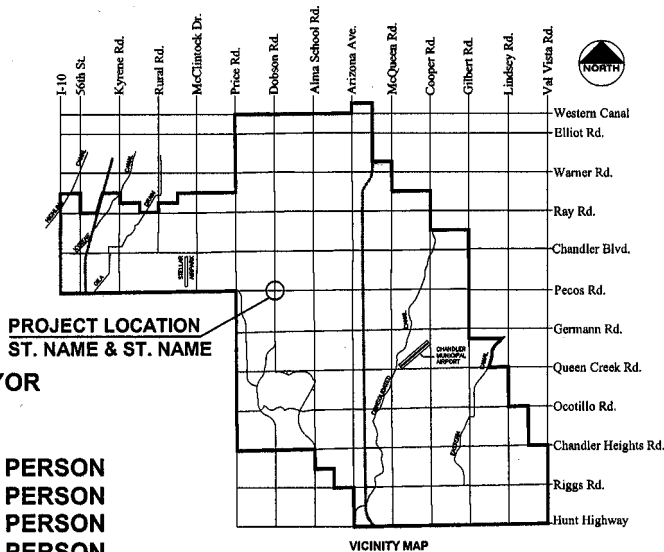
CITY OF CHANDLER, ARIZONA

PROJECT TITLE HERE

MAYOR
CURRENT MAYOR

VICE MAYOR
CURRENT VICE MAYOR

COUNCIL
CURRENT COUNCIL PERSON
CURRENT COUNCIL PERSON
CURRENT COUNCIL PERSON
CURRENT COUNCIL PERSON
CURRENT COUNCIL PERSON



THIS PROJECT



APPROVED:

PUBLIC WORKS DIRECTOR _____ DATE _____

CITY ENGINEER _____ DATE _____

CITY TRANSPORTATION ENGINEER _____ DATE _____

PROJECT NO.

PAGE 1 OF ____

City of Chandler



Chandler + Arizona

COVER SHEET

DETAIL NO.

TS-2

NTS

Proposed

Existing



No. 5 Pull Box



No. 5 Pull Box w/ Extension



No. 7 Pull Box



No. 7 Pull Box w/ Extension



Signal Luminaire on Pole



Power Pole



Control Cabinet



Load Center Cabinet



Railroad Cabinet



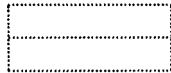
Traffic Signal Pole



Guy Anchor



Conduit Run



Loop Detectors



Luminaire on Mast Arm



Luminaire on Pole w/ Mast Arm



Vehicle Movement



Flashing Amber



Flashing Red

City of Chandler



Chandler + Arizona

PLAN SYMBOLS

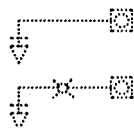
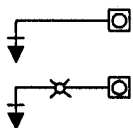
DETAIL NO.

TS-3

NTS

Proposed

Existing



Pole with Mast Arm and Traffic Signal



Traffic Signal



Traffic Signal w/ Directional Arrow



Pedestrian Push Button w/ Sign on Pole



Traffic Signal Illuminated Message



Flasher Signal Head



Pedestrian Push Button w/ Sign on Pole



Signal Pole Number



Conduit Run Number

—G —

Gas Line

—OT —

Overhead Telephone Line

—T —

Burried Telephone Line

—CATV —

Cable Television Line

—W —

Water Line

—SD —

Storm Drain

—SS —

Sanitary Sewer

—OE —

Overhead Electric

—UE —

Underground Electric

City of Chandler



Chandler + Arizona

PLAN SYMBOLS

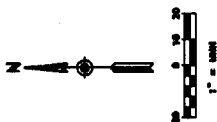
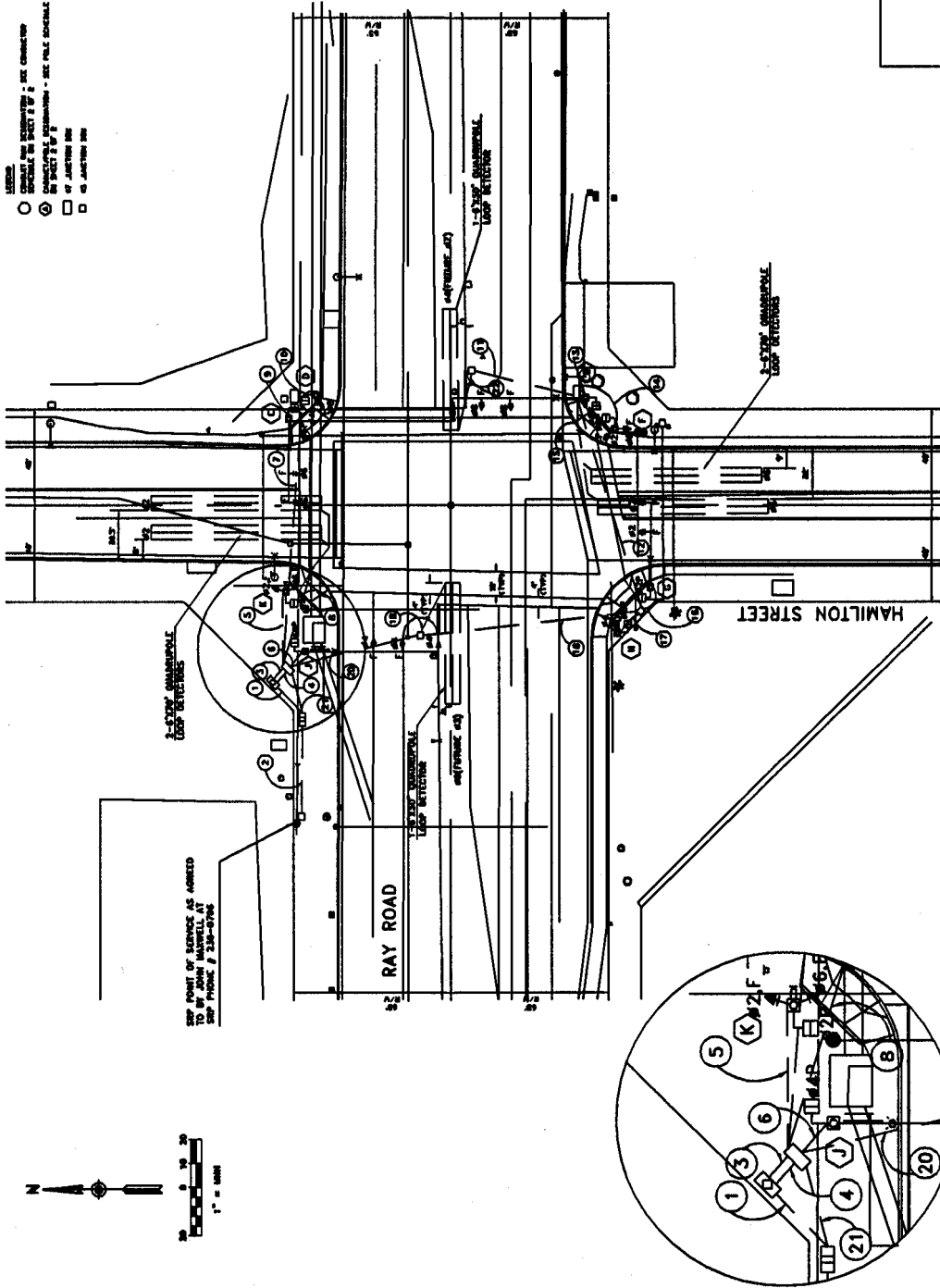
DETAIL NO.

TS-4

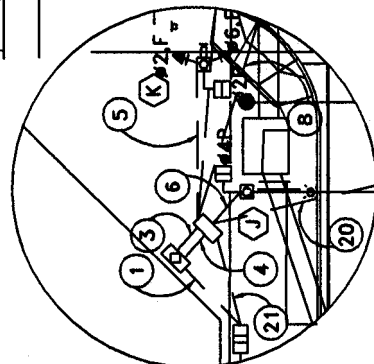
NTS

CONSTRUCTION NOTES:

- LEGEND**
- FORMER AND EXISTING - SEE CONSTRUCTION
 - ① EXISTING 12" DRAINAGE - SEE FILE SCHEDULE
 - ② EXISTING 12" DRAINAGE - SEE FILE SCHEDULE
 - 4" JUNCTION BOX
 - 4" JUNCTION BOX



STOP POINT OF SERVICE IS ADDED
TO 40' FROM HAMILTON ST.
SEE PHONE # 238-4706



CITY OF CHANDLER
Chandler, Arizona 85225

PROJECT NO.	238-4706
DATE	10/20/05
DESIGNED BY	W.C.
CHECKED BY	W.C.
IN CHARGE	W.C.

City of Chandler



Chandler + Arizona

PLAN VIEW (SHEET 1)

DETAIL NO.

TS-5

NTS

CABINET AND POLE SCHEDULE

CABINETS						ASSEMBLY NOTES	LOCATION	
CABINET	TYPE	EQUIPMENT						
<div><div>A</div><div><div><div></div><div></div><div></div><div></div></div><div>PEC</div></div></div>	METER PAD	TESCO OR MYERS				FACE PEC NORTH	LOCATE AS DIRECTED BY CITY OF CHANDLER	
<div><div>B</div><div><div><div></div><div></div></div></div></div>	IV	EAGLE -- SIGNAL EPAC 300 NEMA TS2 8 PHASE CONTROLLER				INSTALL 4' SQUARE X4" CONCRETE WORK PAD IN FRONT OF FOUNDATION WITH 8" TOE IN FRONT	LOCATE AS DIRECTED BY CITY OF CHANDLER	
POLES		MAST ARMS		SIGNAL ASSEMBLIES		PED. DET. SIGN	NOTES	LOCATION
ORIENTATION PLAN	TYPE	SIG	LUM	MTG	FACE			
<div><div>C</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>12'</div><div>12'</div><div>N↓</div></div></div>	Q	35'	12'	2-II 1-V	2-F 1-M/H		NOTE 1 NOTE 3 NOTE 4	LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>D</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>N↓</div></div></div>	A 10'			1-IV 1-V	1-Q 1-M/H	T.S.11-4 R10-4b(R)	NOTE 2	LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>E</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>12'</div><div>12'</div><div>N↑</div></div></div>	R	55'	20'	3-II 1-V	1-Q 2-F 1-M/H	T.S.11-4 R10-4b(L)	NOTE 1 NOTE 2 NOTE 3 NOTE 4	LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>F</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>N↑</div></div></div>	A 10'			1-VI 1-V	2-F 1-M/H			LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>G</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>12'</div><div>N↑</div></div></div>	Q	35'	12'	2-II 1-V	2-F 1-M/H		NOTE 1 NOTE 3 NOTE 4	LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>H</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>N↑</div></div></div>	A 10'			1-IV 1-V	1-Q 1-M/H	T.S.11-4 R10-4b(R)	NOTE 2	LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>J</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>12'</div><div>12'</div><div>N↑</div></div></div>	R	55'	20'	3-II 1-V	1-Q 2-F 1-M/H		NOTE 1 NOTE 3 NOTE 4	LOCATE AS DIRECTED BY CITY OF CHANDLER
<div><div>K</div><div><div><div></div><div></div></div><div><div></div><div></div></div><div>N↑</div></div></div>	A 10'			1-VI 1-V	2-F 1-M/H	T.S.11-4 R10-4b(L)	NOTE 2	LOCATE AS DIRECTED BY CITY OF CHANDLER

NOTES:

1. INSTALL 3M "OPTICOM" 700 SERIES DETECTOR ON MAST ARM.
2. TYPE I PEDESTRIAN PUSH BUTTON - T.S. 11 - 1.
3. 250 WATT LUMINAIRE, TYPE III, MEDIUM CUTOFF, 120 VOLT.
4. INSTALL ILLUMINATED STREET SIGN.

City of Chandler



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CABINET AND POLE SCHEDULE

DETAIL NO.

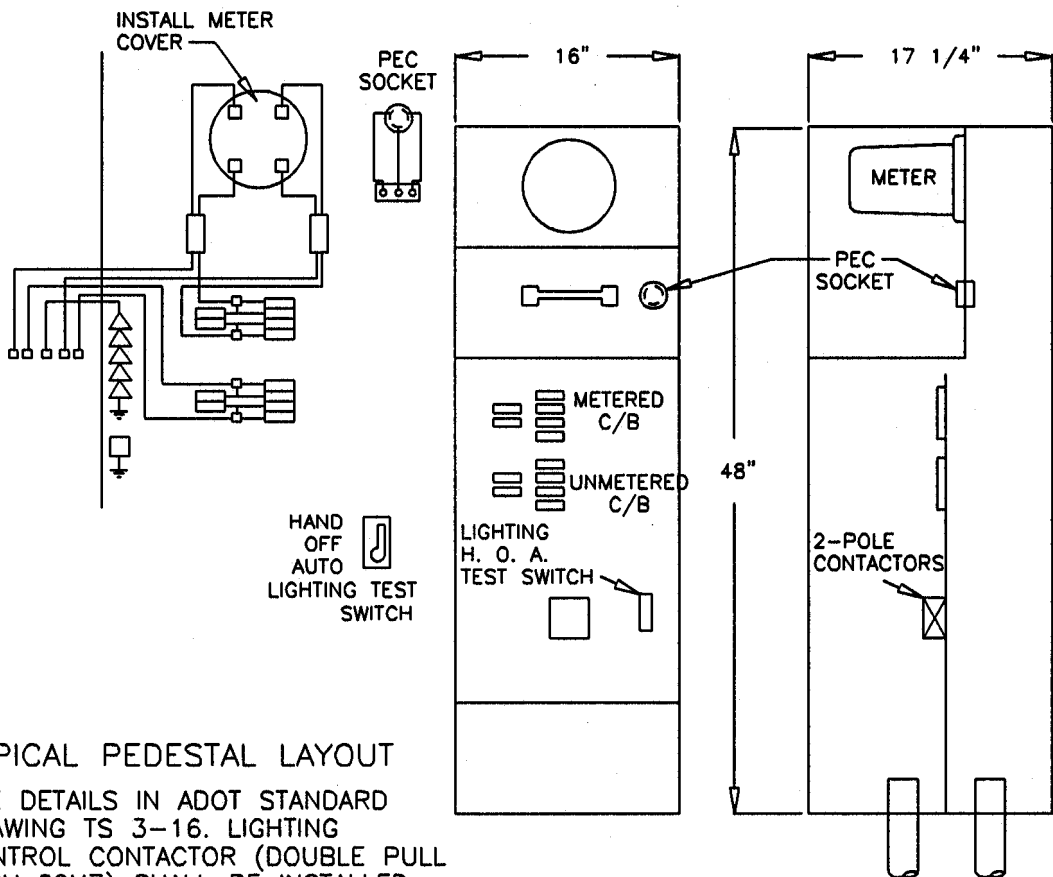
TS-7

NTS

CITY OF CHANDLER STANDARD NEMA PHASING

PHASE 1 - NORTHBOUND LEFT TURN
 PHASE 2 - SOUTHBOUND THRU
 PHASE 3 - EASTBOUND LEFT TURN
 PHASE 4 - WESTBOUND THRU

PHASE 5 - SOUTHBOUND LEFT TURN
 PHASE 6 - NORTHBOUND THRU
 PHASE 7 - WESTBOUND LEFT TURN
 PHASE 8 - EASTBOUND THRU



TYPICAL PEDESTAL LAYOUT

SEE DETAILS IN ADOT STANDARD DRAWING TS 3-16. LIGHTING CONTROL CONTACTOR (DOUBLE PULL 120V 60HZ) SHALL BE INSTALLED FOR SIGNAL WITH STREET LIGHT LUMINAIRES. PROVIDE 50 AMP BREAKER FOR SIGNAL SERVICE. PROVIDE DOUBLE PULL 20 AMP BREAKER FOR STREET LIGHTS.

TRAFFIC SIGNAL METER PEDESTAL

City of Chandler



Chandler + Arizona

NEMA PHASING AND METER PEDESTAL

DETAIL NO.

TS-8

NTS

		CONDUCTOR SCHEDULE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		CONDUIT RUN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						

- - INSTALLED BY SRP
- ▲ - LOOP DUCT #14 THWN WIRE IN PVC TUBING
- * - EXISTING

CONDUCTOR NOTES:

- (1) MINIMUM NUMBER OF CONDUCTORS REQUIRED (NON-I.M.S.A. TYPE)
- (2) MINIMUM NUMBER OF CABLES REQUIRED (INCLUDING I.M.S.A. TYPES)
- (3) COLOR CODE FOR I.M.S.A. CABLE RUN

City of Chandler



Chandler + Arizona

CONDUCTOR SCHEDULE

DETAIL NO.

TS-9

NTS

I.M.S.A. 20-1 CABLE PHASING SCHEDULE

POLE C-WHITE(3)	POLE E-ORANGE(3)	POLE G-BROWN(3)	POLE J-BLUE(3)
Ø6 R-Y-G	Ø8 R-Y-G	Ø2 R-Y-G	Ø4 YA-GA
Ø6 W-DW	Ø8 YA-GA	Ø2 W-DW	Ø4 R-Y-G
	Ø8 W-DW		Ø4 W-DW
	Ø6 PED P.B.		
	PED P.B. COMMON		
SIGNAL COMMON	SIGNAL COMMON	SIGNAL COMMON	SIGNAL COMMON
POLE D-RED(3)	POLE F-YELLOW(3)	POLE H-GREEN(3)	POLE K-BLACK(3)
Ø8 RA-GA-YA	Ø2 R-Y-G	Ø4 RA-GA-YA	Ø6 R-Y-G
Ø4 W-DW	Ø6 R-Y-G	Ø8 W-DW	Ø2 R-Y-G
	Ø6 W-DW		Ø2 W-DW
Ø6 PED P.B.		Ø2 PED P.B.	Ø2 PED P.B.
PED P.B. COMMON		PED P.B. COMMON	PED P.B. COMMON
SIGNAL COMMON	SIGNAL COMMON	SIGNAL COMMON	SIGNAL COMMON

City of Chandler



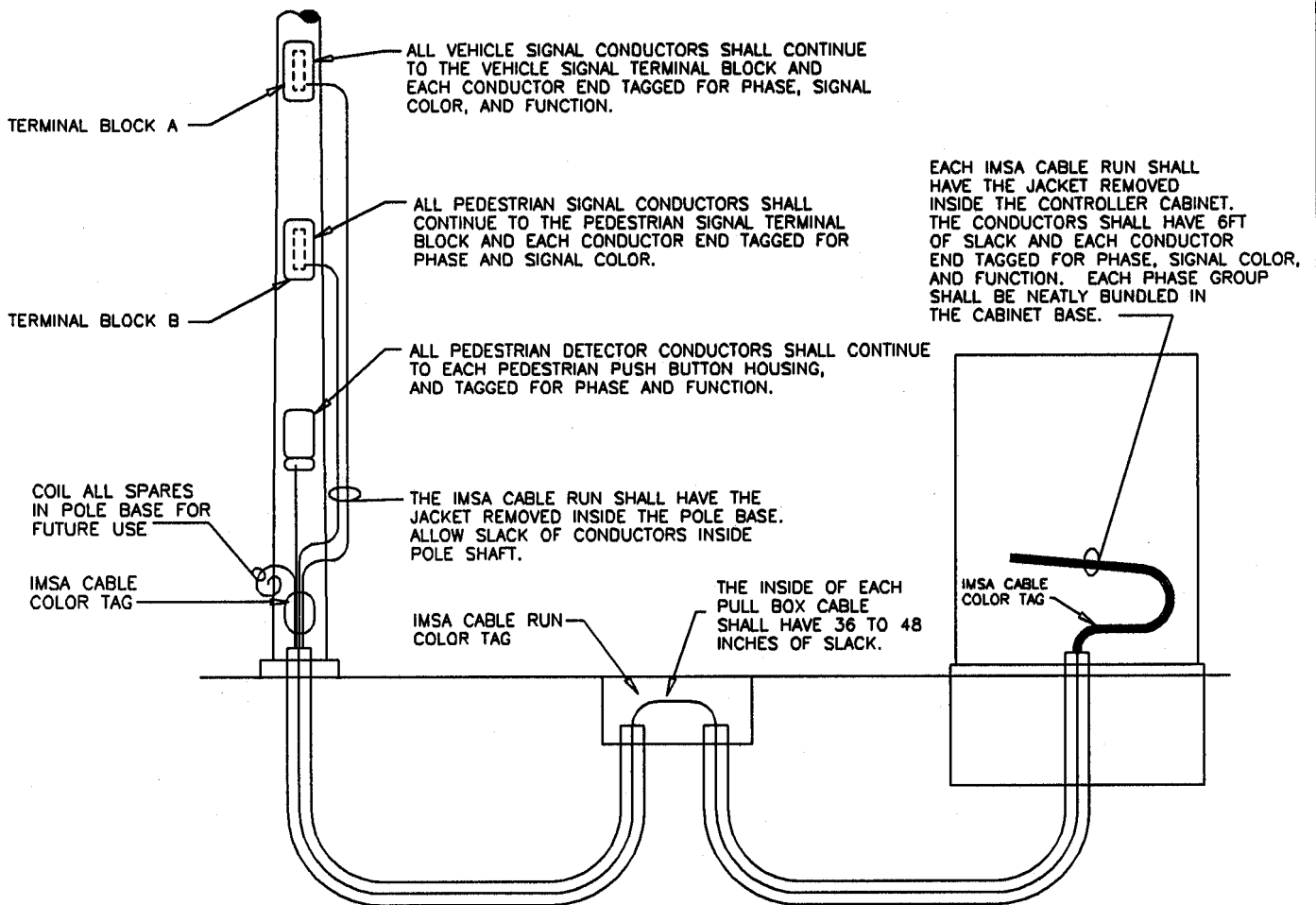
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CABLE PHASING SCHEDULE

DETAIL NO.

TS-10

NTS



EACH IMSA 20-1 CABLE RUN SHALL BE CONTINUOUS FROM THE SPECIFIC TRAFFIC SIGNAL POLE TO THE TRAFFIC SIGNAL CONTROLLER CABINET, WITHOUT THE USE OF ANY SPLICES.

City of Chandler



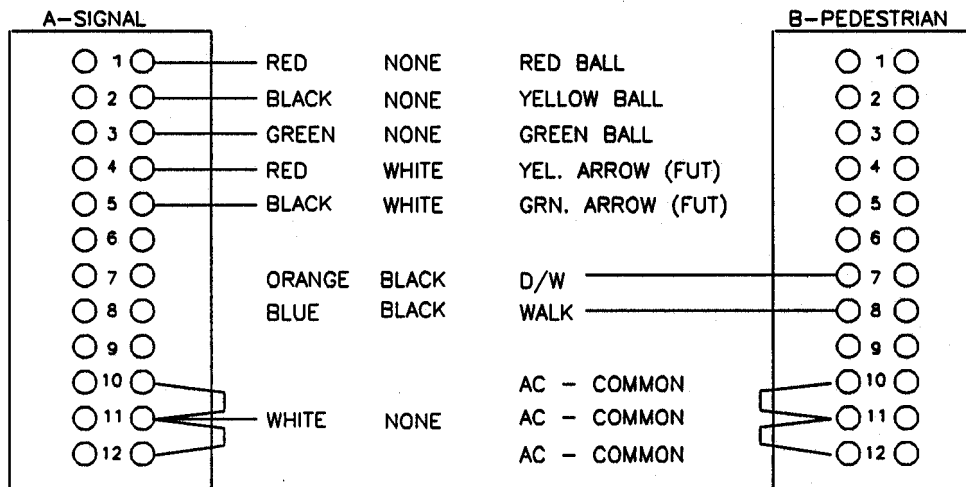
Chandler + Arizona

INSTALLATION OF I.M.S.A. SIGNAL CABLES

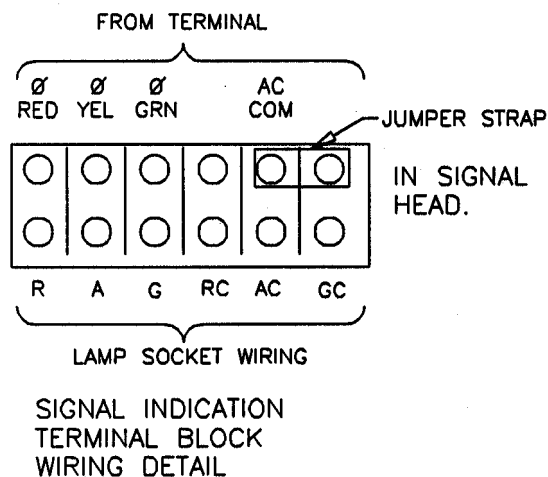
DETAIL NO.

TS-11

NTS

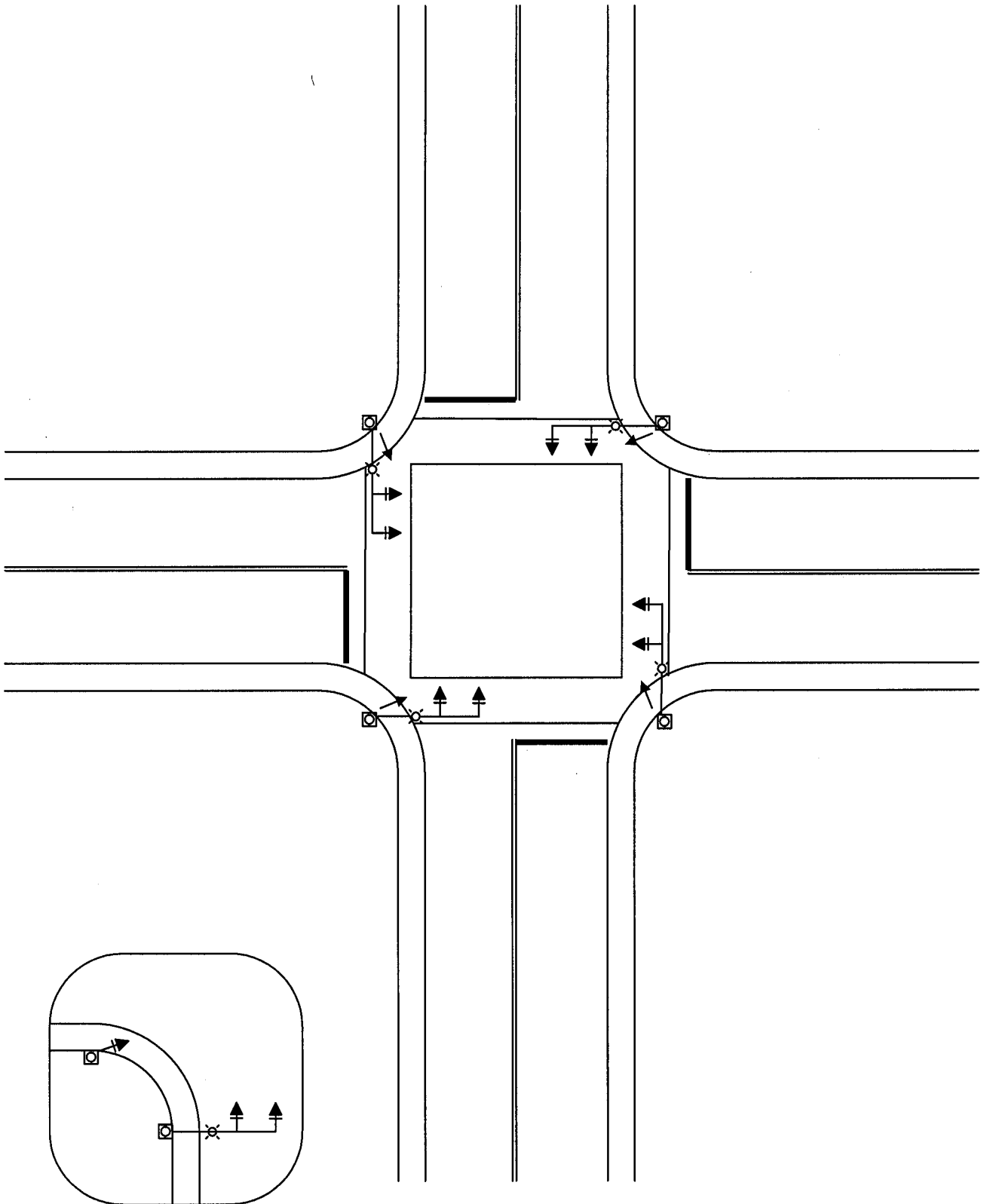


TERMINAL BLOCKS



SIGNAL INDICATION TERMINAL
BLOCK WIRING DETAIL





ALTERNATE A-POLE DESIGN

City of Chandler



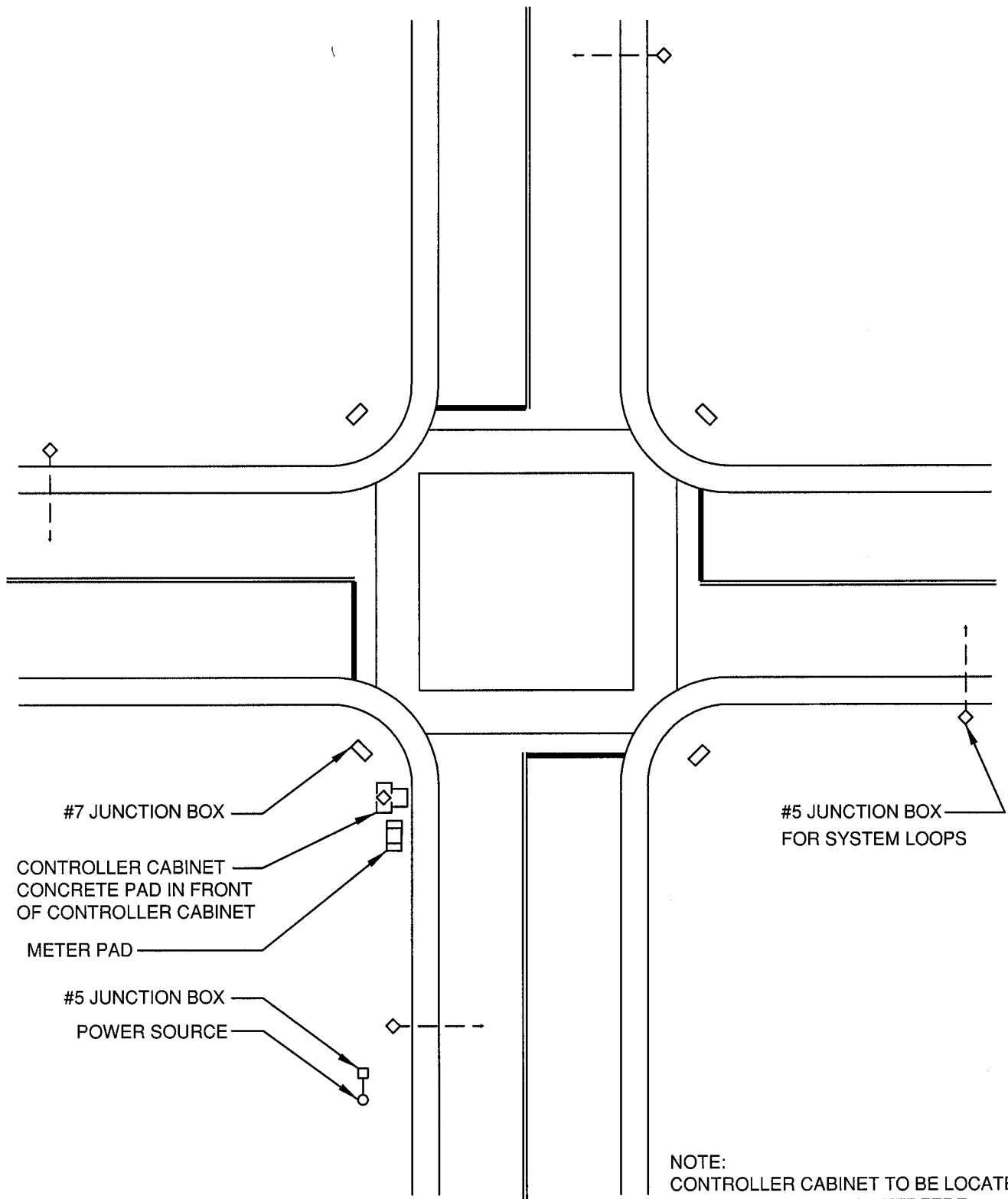
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TYPICAL POLE LAYOUT

DETAIL NO.

TS-13

NTS



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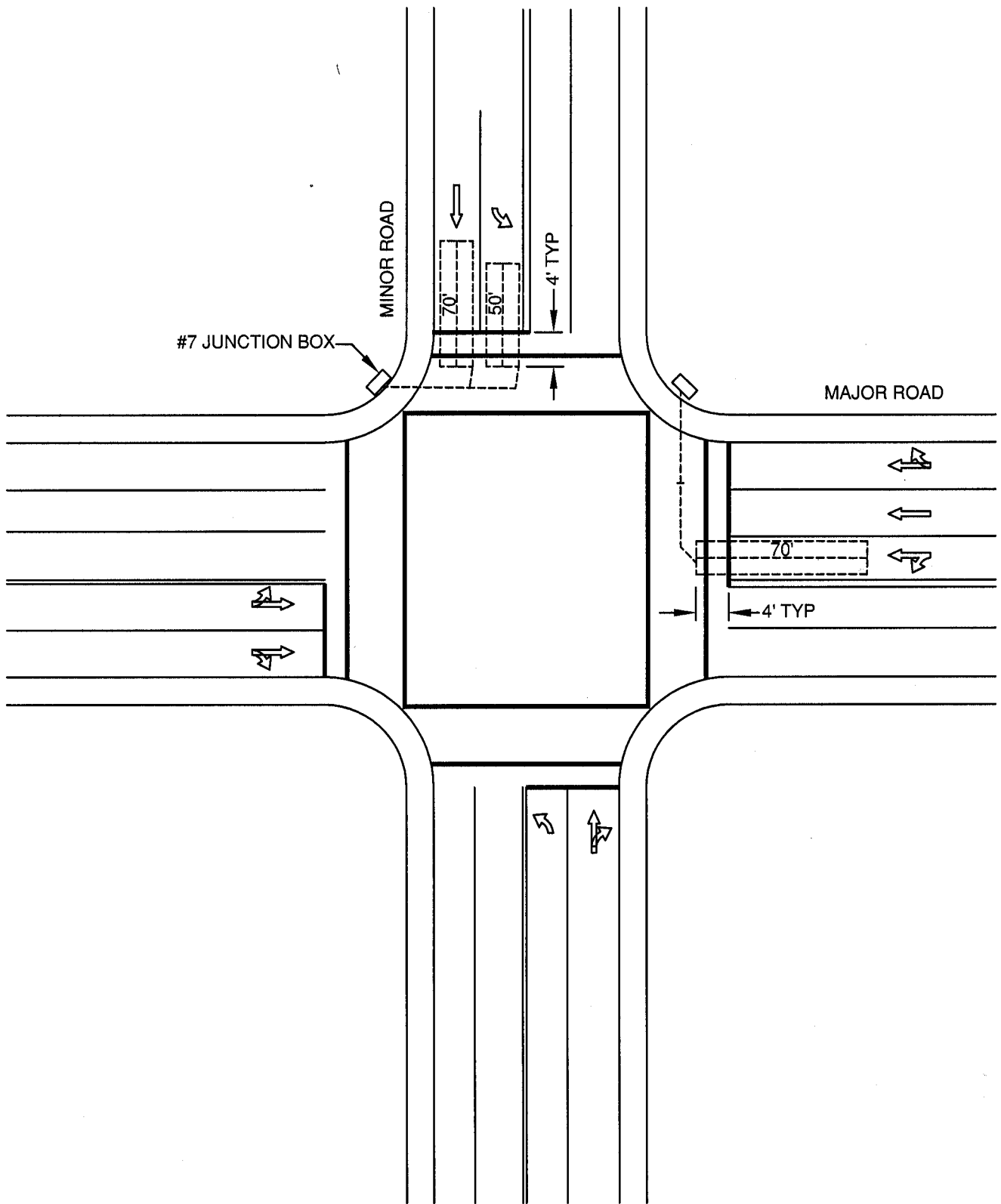
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JUNCTION BOX LOCATIONS

DETAIL NO.

TS-14

NTS



City of Chandler



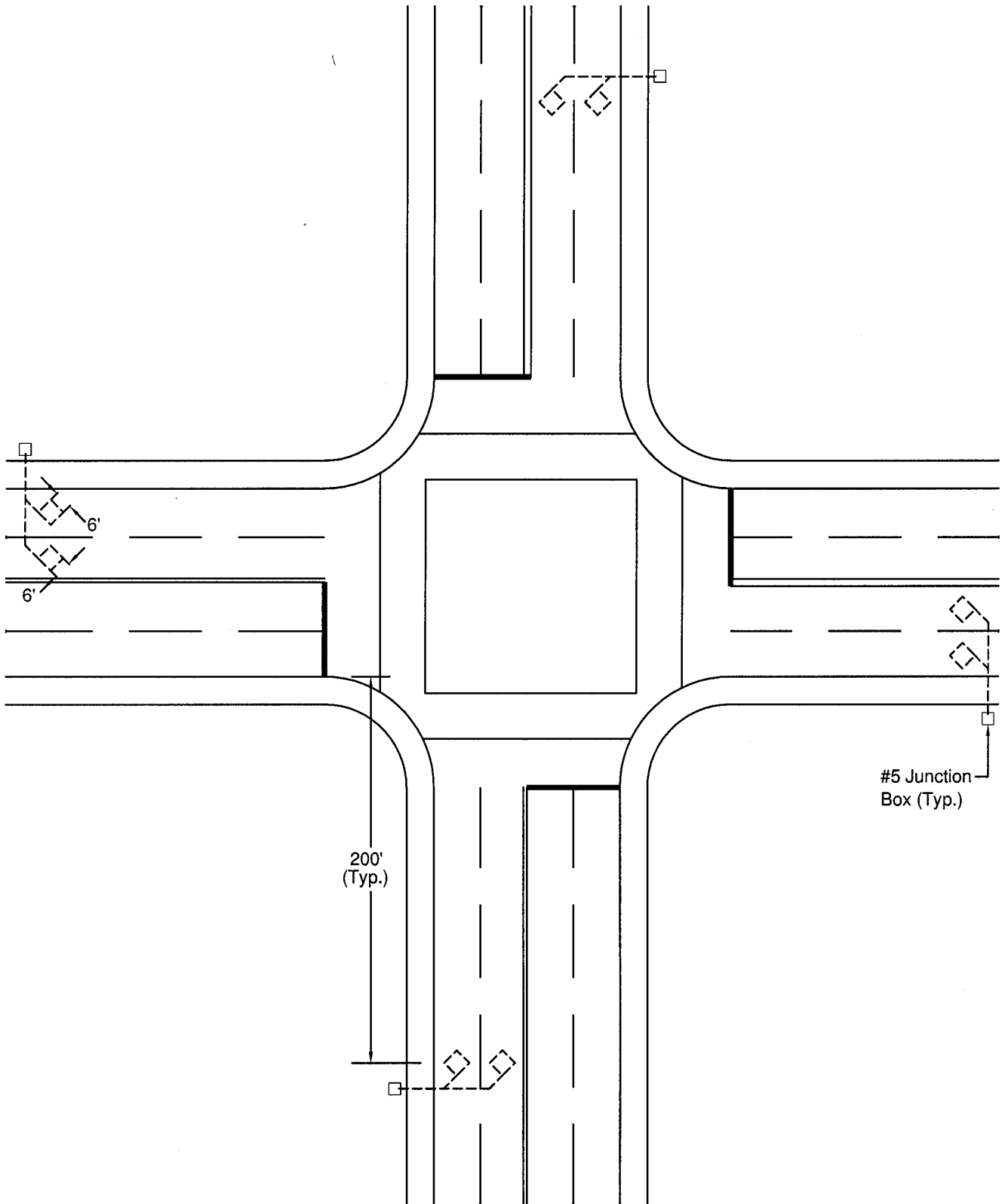
Chandler + Arizona

LOOP DETECTOR PLACEMENT

DETAIL NO.

TS-15

NTS



City of Chandler



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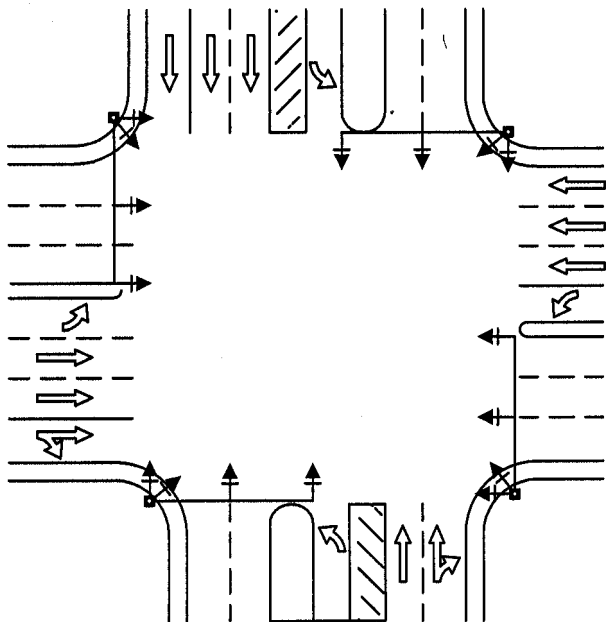
SYSTEM LOOP PLACEMENT

DETAIL NO.

TS-16

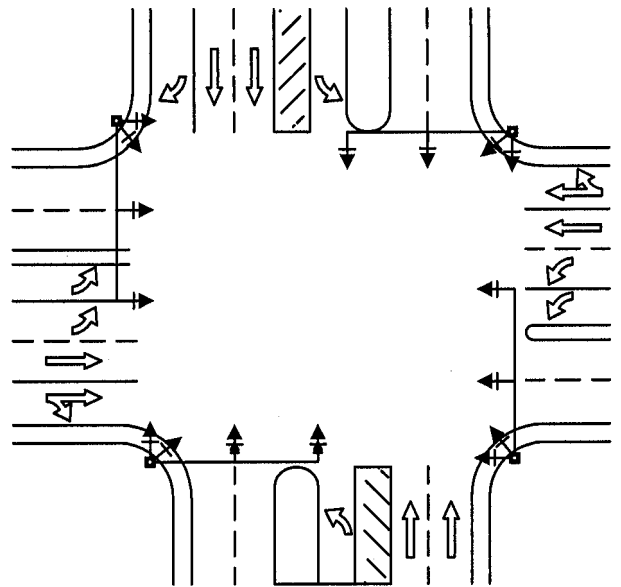
NTS

**ARTERIAL - ARTERIAL INTERSECTION
>60' ARTERIAL**



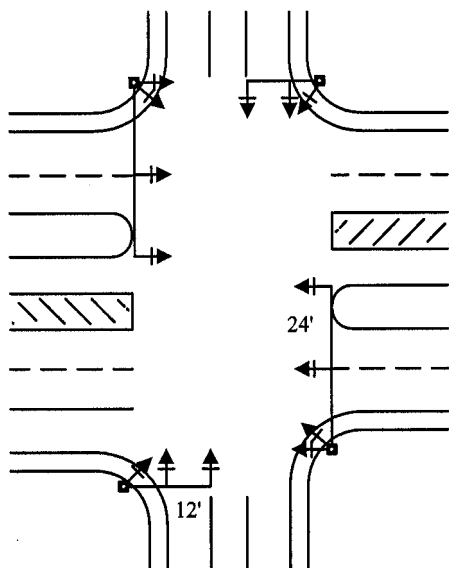
LEFT TURN PHASE ALL DIRECTIONS
SINGLE LEFT TURNS

**ARTERIAL - ARTERIAL INTERSECTION
>60' ARTERIAL**



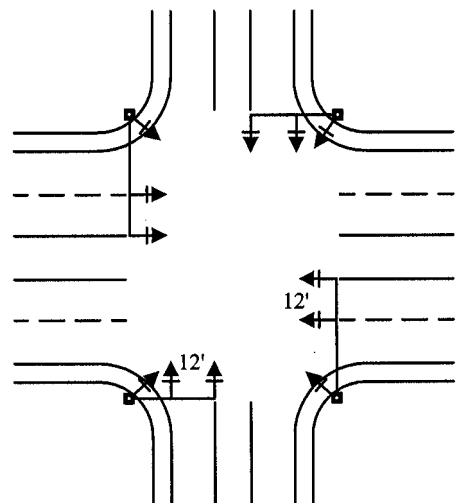
LEFT TURN PHASE ALL DIRECTIONS
DOUBLE LEFT TURNS

**ARTERIAL - COLLECTOR INTERSECTION
>60' ARTERIAL**



LEFT TURN PHASE

**ARTERIAL - COLLECTOR INTERSECTION
60' ARTERIAL**



NO LEFT TURN PHASES

City of Chandler



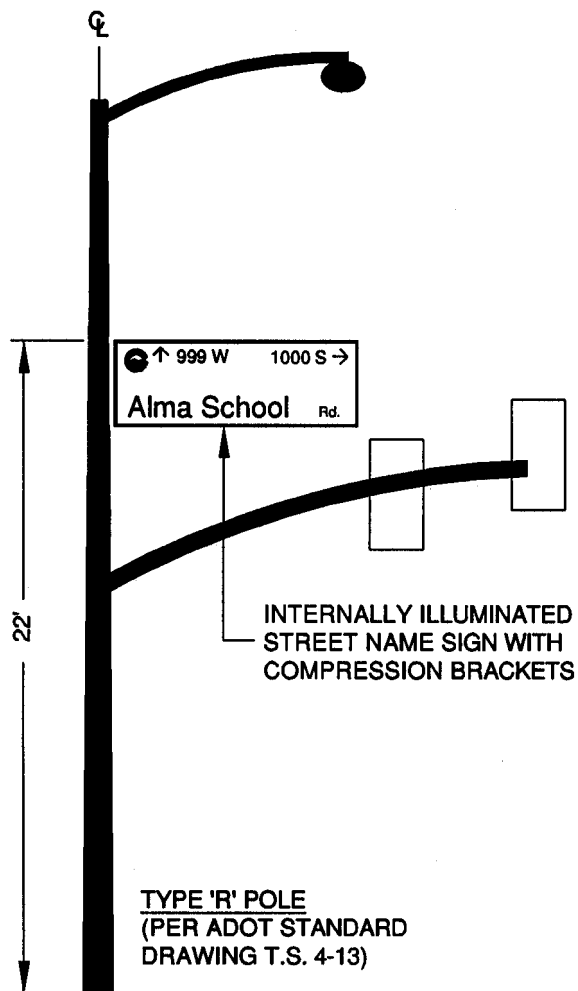
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**SIGNAL HEAD
PLACEMENT**

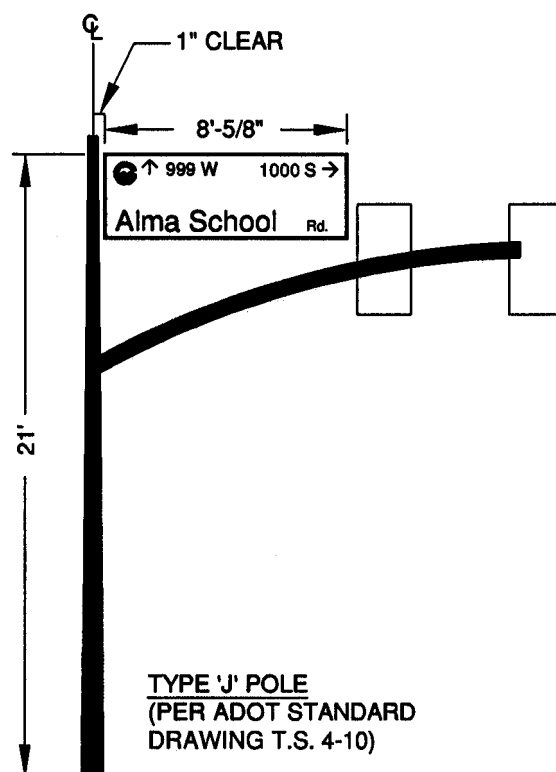
DETAIL NO.

TS-17

NTS



ELEVATION



ELEVATION

City of Chandler



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INTERNALLY ILLUMINATED SIGNS

DETAIL NO.

TS-18

NTS